

Potential Effects of Aquatic Nuisance Species on the Behavior of Recreational Anglers, Boaters, and Beachgoers



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Executive Summary

This report summarizes the findings from a series of focus groups conducted as part of the United States Army Corps of Engineers/Cornell University “Recreation Impacts of Aquatic Nuisance Species to the Great Lakes and Mississippi River Basins” cooperative agreement. The overall purpose was to describe how and why aquatic nuisance species in the Upper Mississippi River, Ohio River, and Great Lakes basins may affect recreational behaviors of angler, boaters, and beachgoers. Understanding the ways that recreationists may respond to the presence of aquatic nuisance species and the particular effects of these species that may lead to this response is necessary for understanding the impacts of aquatic nuisance species on recreationists. This work will be used as a foundation for later research on the economic impacts of aquatic nuisance species on recreationists.

Eight focus groups were conducted with anglers, three with recreational boaters, and three with recreational beachgoers. A focus group is a type of collective interview in which a researcher brings together a group of people to discuss their views on a particular topic. The researcher acts as a facilitator who introduces several open-ended questions, but who also helps each participant to build off responses given by the other participants. Focus groups allow for thoughts, ideas, and viewpoints to emerge that may not be detected in a one-on-one exchange, but that develop and surface in open dialogue. Such methods are intended to provide greater depth of understanding than can commonly be achieved in a large sample quantitative survey.

A number of factors, including, but not limited to aquatic nuisance species, influenced the recreational behavior of anglers, boaters, and beachgoers. In each user group, the factors cited most often by focus group participants as affecting fishing, boating, and beachgoing behavior were related to the potential effects of aquatic nuisance species. Anglers expressed concerns about catch rate and fish size—and fishing quality more generally—based on impacts from aquatic nuisance species. Secondary effects of aquatic nuisance species—such as the inconvenience or expense of shifting fishing location--were also described. Other influences on behavior were identified that did not link to aquatic nuisance species (e.g., weather, access to fishing sites, social relationships). Boater and beachgoer behavior were tied to aquatic nuisance species-related issues such as water clarity, health and safety, and visual beauty.

Most of the potential impacts of aquatic nuisance species on recreation seemed to be negative, such as limiting the number of locations in which recreation is desirable, causing some forms of recreation to become more difficult, less fun, or less safe, and perhaps leading some people to forsake certain activities altogether. Nevertheless, a few impacts from aquatic nuisance species could be positive. For example, the increased water clarity provided by zebra mussels appealed to many focus group participants.

Even though the focus group participants seemed to be affected primarily negatively by aquatic nuisance species, they frequently showed a willingness to adapt rather than becoming frustrated to the point that they would cease participation entirely. Substituting different locations or forms of preferred recreational activities (e.g., types of fishing, uses of beaches,

etc.) for current ones was a frequently cited approach to dealing with aquatic nuisance species. Recreationists repeatedly asserted that they would adapt and continue to recreate, even if it left them with a diminished experience.

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I. Study Background

GLMRIS Background Information

The United States Army Corps of Engineers (USACE), in consultation with other federal agencies, Native American tribes, state agencies, local governments and non-governmental organizations, is conducting the Great Lakes and Mississippi River Interbasin Study (GLMRIS). In accordance with the study authorization, USACE will evaluate a range of options and technologies (collectively known as "ANS controls") to prevent the spread of aquatic nuisance species between the Great Lakes and Mississippi River basins by aquatic pathways.

An aquatic nuisance species (ANS) is a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters. See 16 U.S.C. § 4702(1) (FY13).

As a result of international commerce, travel and local practices, ANS have been introduced throughout the Mississippi River and Great Lakes basins. These two basins are connected by man-made channels that, in the past, exhibited poor water quality, which was an impediment to the transfer of organisms between the basins. Now that water quality has improved, these canals allow the transfer of both indigenous and nonindigenous invasive species.

USACE is conducting a comprehensive analysis of ANS controls and will analyze the effects each ANS control or combination of ANS controls may have on current uses of: (a) the Chicago Area Waterway System (CAWS), the only known continuous aquatic pathway between the Great Lakes and Mississippi River basins; and (b) other aquatic pathways between these basins. Following the *Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies*, Water Resource Council, March 10, 1983, USACE will:

- Inventory current and forecast future conditions within the study area;
- Identify aquatic pathways that may exist between the Great Lakes and Mississippi River basins;
- Inventory current and future potential aquatic nuisance species;
- Analyze possible ANS controls to prevent ANS transfer, to include hydrologic separation of the basins;
- Analyze the impacts each ANS control may have on significant natural resources and existing and forecasted uses of the lakes and waterways within the study area; and
- Recommend a plan to prevent ANS transfer between the basins. If necessary, the plan will include mitigation measures for impacted waterway uses and significant natural resources.

Significant issues associated with GLMRIS may include, but are not limited to:

- Significant natural resources such as ecosystems and threatened and endangered species;
- Commercial and recreational fisheries;
- Current recreational uses of the lakes and waterways;
- ANS effects on water users; and
- Effects of potential ANS controls on current waterway uses such as flood risk management, commercial and recreational navigation, recreation, water supply, hydropower and conveyance of effluent from wastewater treatment plants and other industries.

GLMRIS Navigation and Economics Product Delivery Team

In support of GLMRIS, the Navigation and Economics Product Delivery Team (PDT) was formed. The PDT was tasked with assessing the current value of *economic* activities within the GLMRIS detailed study area that *could* change with the implementation (Future With Project (FWP) condition) or lack of implementation (Future Without Project (FWOP) condition) of a GLMRIS project. The PDT is comprised of several sub-teams, each of which focuses on a specific economic activity within the GLMRIS study area.

Fisheries Economics Team

The Navigation and Economics PDT's Fisheries Economics Team focused on fishing activities within the U.S. waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins (i.e., the GLMRIS detailed study area) that *could* change in the FWOP and/or FWP condition.

Five baseline economic assessments, which quantitatively or qualitatively describe the current economic activities dependent on fisheries, were developed. The reports focus on the following categories: commercial, recreational, charter, and subsistence fishing, as well as professional fishing tournaments. Each baseline assessment focuses exclusively on the specified fishing activity within the GLMRIS detailed study area – to include the U.S. waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins. It is imperative to note that collectively, these values do *not* represent a comprehensive value of these three basins. Each basin has further economic (e.g., non-use values) and environmental values that are not captured in this economic appendix. Rather, the fishing-related economic activities assessed by the Fisheries Economics Team serve as indicators of key aspects of the economy that *could* change in the future, with or without the implementation of a GLMRIS project.

Report Purpose

In support of GLMRIS, Cornell University (CU) was tasked, in part, with estimating how recreational activities – that take place within the Great Lakes Basin (GL), and Upper Mississippi River and Ohio River Basins (UMORB) – would be impacted by the transfer of ANS between these basins. Specifically, this document describes the findings of fourteen focus groups that

were conducted in order to establish the potential effects of ANS transfer between the GL and UMORB on the behavior of recreational anglers, boaters, and beachgoers within these basins.

The overall purpose of this report is to describe how interactions with aquatic nuisance species in the UMORB and GL basin will likely affect recreational behaviors related to interaction with aquatic environments in these basins. The portions of the study area that were of particular interest were the Great Lakes, the Upper Mississippi and Ohio Rivers, and those lakes, ponds, rivers, and streams that are not separated from these water bodies by any barriers impassable to fish (dams, waterfalls, etc.). It is these waters that USACE considers susceptible to the effects of possible ANS transfer between the Great Lakes basin and the UMORB (in either direction).

Aquatic nuisance species may have a range of effects on aquatic systems, and some of these effects may influence whether and how anglers, boaters, and beachgoers choose to recreate. Behaviors with economic implications are of particular interest. Eight focus groups were conducted with anglers, three with recreational boaters, and three with recreational beachgoers providing qualitative data that allow for a better understanding of the major influences (for example, the desires, experiences, and constraints) that shape behavior of all three recreational groups. An understanding of the factors that shape recreational behavior allows assessment of whether and how (further) introduction of aquatic nuisance species could affect recreational communities. The results reported reveal some patterns in how behaviors may change as a result of aquatic nuisance species (for example, location, frequency, or type of recreation).

II. Theoretical Background

Data collection and analysis were guided by a well-established theory of characteristics that lead to behavior change called the Theory of Planned Behavior (Ajzen, 1991, 2002; Ajzen et al., 2011). This theory asserts that three major sets of factors will predict an individual's intentions to behave in a certain way (e.g., to engage in a particular type of recreation): (a) attitudes (e.g., perceptions about what is good or bad, desirable or undesirable, useful, meaningful, etc.); (b) perceived norms (i.e., one's beliefs about which actions other people, who are important to the individual, think the individual should take); and (c) perceived control (i.e., one's ability to actually engage in an activity, due to personal as well as external factors). The focus groups were used to collect data about which factors influence the recreational behaviors of anglers, boaters, and beachgoers with a particular focus on those factors that could be influenced by the spread of (additional) aquatic nuisance species into the area.

The primary way that aquatic nuisance species might affect user behavior was through changes in resource quality – characteristics of the resource that are important to recreational users (size of fish populations, water quality, presence of weeds, etc.). The US Army Corps of Engineers provided preliminary assessments of the types of effects that aquatic nuisance species might have on resource quality. During the focus groups, these potential occurrences were discussed with representatives of user groups to gauge how they would likely respond.

III. Methods

Focus groups were conducted in fourteen locations throughout the study area (Figure 1 and Table 1). A focus group is a type of collective interview in which a researcher brings together a group of people, interested in and informed about a particular topic, to discuss their views on that topic. The researcher acts as a facilitator who introduces several open-ended questions, but who also helps each participant to build off responses given by the other participants. The researcher only asks questions and does not provide information or correct inaccurate statements because participants are less likely to share their perspectives freely if they expect their responses to be critiqued. Focus groups are designed to provide in depth information from people about topics for which their possible responses might not be able to be predicted in advance. A focus group approach was adopted for this research because the literature available did not clearly indicate the different types of influences that would likely lead to behavior change for the different user groups of interest in this study. Focus groups allow for thoughts, ideas, and viewpoints to emerge that may not be detected in a one-on-one exchange, but that develop and surface in open dialogue; they also allow participants to offer impressions of whether or not the group generally has consensus on an issue or perspective. They are not intended to provide statistically valid representations of a particular place or group in the same way provided by a random sample quantitative survey instrument.

Participants for the fourteen focus groups were identified through a variety of methods. At some locations, researchers had previously worked with individuals (staff members of state fish and wildlife agencies, Sea Grants, local parks, etc.) who worked with recreational users in that

Figure 1. Map of study area showing locations of focus groups.

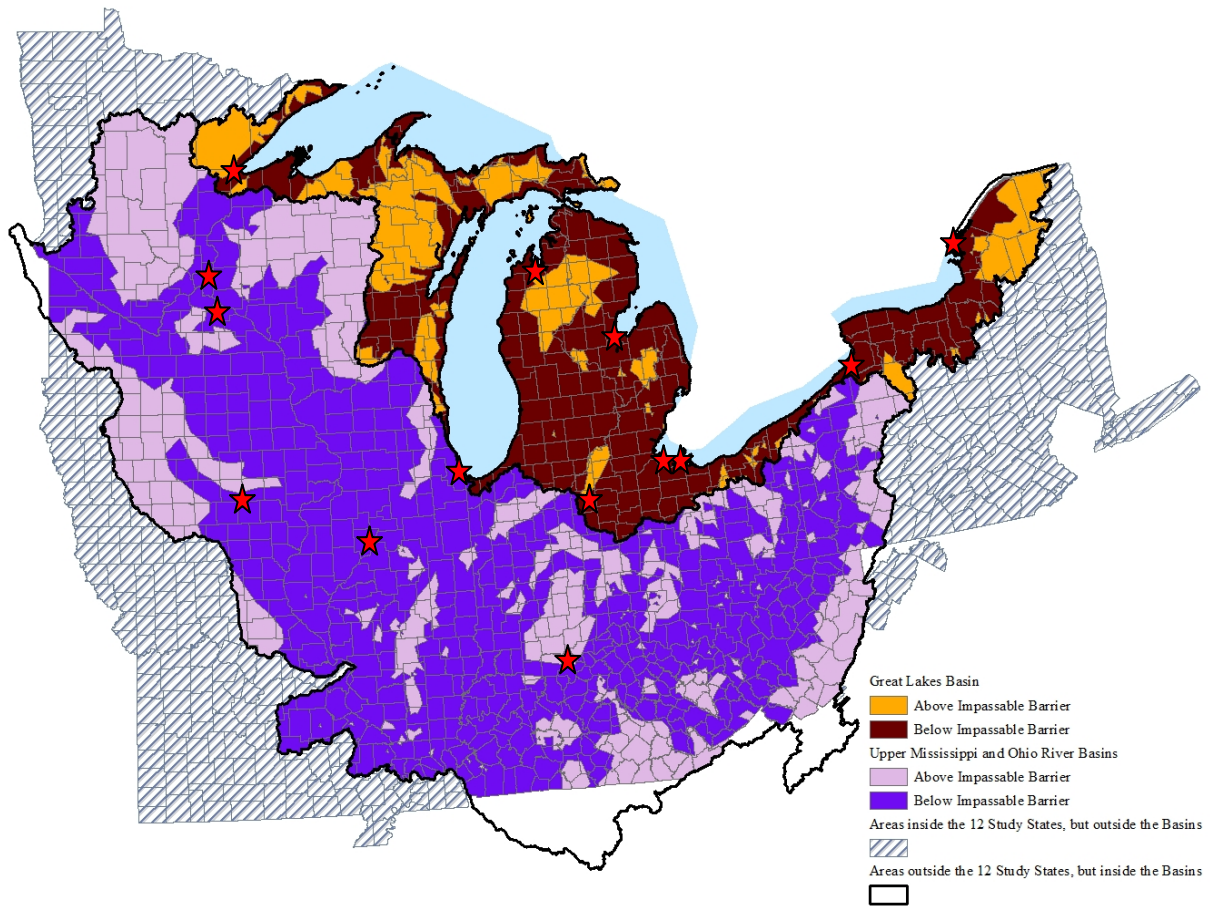


Table 1. Focus Group Characteristics

Location	Date	Recreational group interviewed	Number of participants	Duration of discussion
Oswego, NY	Nov. 7, 2011	Anglers	8	1h 45m
Peoria, IL	Nov. 15, 2011	Anglers	6	1h 32m
Eagan, MN	Nov. 16, 2011	Anglers	11	1h 54m
Duluth, MN	Nov. 17, 2011	Anglers	21	1h 58m
Port Clinton, OH	Dec. 5, 2011	Anglers	8	2h 08m
Bay City, MI	Dec. 13, 2011	Anglers	8	2h 14m
Fort Wayne, IN	Dec. 14, 2011	Anglers	15	1h 59m
Louisville, KY	Dec. 15, 2011	Anglers	15	2h 00m
Traverse City, MI	Apr. 10, 2012	Beachgoers	11	1h 27m
Chicago, IL	Apr. 11, 2012	Beachgoers	9	1h 33m
Minneapolis, MN	May 9, 2012	Beachgoers	13	1h 43m
Alexandria Bay, NY	May 2, 2012	Boaters	11	1h 32m
Put-in-Bay, OH	May 6, 2012	Boaters	9	1h 26m
Pella, IA	May 10, 2012	Boaters	14	1h 14m

area. In these locations, recruitment started with “snowball sampling” (i.e., contacting individuals who have knowledge of recreational users in a location and asking for recommendations of people to participate, then contacting those individuals, asking them to participate and asking for additional suggestions). In addition to snowball sampling, and particularly in locations where the researchers had no contacts, recruitment occurred by way of announcements in local newspapers and announcements via e-mail list-serves of organizations supportive of the research being conducted. The focus groups lasted between 1 hour 14 minutes and 2 hours 14 minutes, with an average duration of 1 hour 45 minutes; they

contained between 6 and 21 participants with an average attendance of slightly over 11 individuals. The size of the interviews was established to allow for a variety of perspectives to emerge on how aquatic nuisance species, and other factors, could influence the recreational behaviors of interest. Random sample statistics are irrelevant to data analysis of focus groups and, therefore, did not influence sample selection.

The majority of the focus groups were conducted with anglers because the data from this group were not only being used to understand how aquatic nuisance species would most likely affect recreational behaviors, but also to design a follow up survey to anglers about the effects of nuisance species on fishing behavior. All of the focus groups contributed to an understanding of how major recreational groups could be affected by the (further) introduction of aquatic nuisance species, and allowed for identification of similarities and differences between the potential impacts on each of the three recreational groups. The findings related to each recreational group are discussed in the Results section below; the report concludes with a discussion of the similarities and differences between recreational groups.

The focus groups were conducted either by a single facilitator or by a team of two facilitators, with one person leading the questioning and the other helping with follow up questions. The same facilitator led all the angler groups, with an additional facilitator present at three of the groups. Another facilitator conducted all the beachgoer and boater interviews. All four facilitators were trained in advance and participated in practice interviews.

The facilitators approached each interview with a list of major questions and follow up questions (see Appendices A, B, C), vetted through the pilot interview process and by the US Army Corps of Engineers. In all three sets of interviews, the questioning started by asking participants why, where, and how often they engaged in the relevant form of recreation (i.e., fishing, boating, or beachgoing). Next, they were asked whether their recreational behaviors had changed in the past, and then to explain what factors led them to change, or would conceivably lead them to change their behaviors. The participants were asked for any factors that affect their recreational behavior, not just those directly or indirectly linked to aquatic nuisance species. This was for the practical reason that it might be very difficult for someone to identify all the ways in which aquatic nuisance species affect him/her indirectly. More importantly, understanding the extent to which factors not related to aquatic nuisance species affect recreational behaviors can help reveal the relative importance of aquatic nuisance species in shaping behavior.

Finally, the participants were asked to comment on the extent to which certain specific factors (related to aquatic nuisance species) would cause them to change their recreation behaviors. Additional follow up questions, as appropriate, explored further statements made by participants during the interviews. The facilitators audio recorded each interview; trained transcriptionists were employed to transcribe verbatim each of the fourteen interviews.

Coding

After transcription, three researchers (the two primary facilitators for the focus groups and a third individual who did not participate in the groups) were trained to code the transcripts. Coding is a process by which the transcripts are examined for words or phrases that indicate certain concepts of interest. In this study, the words and phrases of interest were those identifying factors that might influence recreational behavior. For example, an important code/factor in the angler focus groups was fish size. Anytime a focus group participant made a comment about fish size in some way influencing his or her fishing behavior, the coders marked the phrase that contained this reference as “fish size.” A single phrase could have multiple codes associated with it.

In collaboration with other researchers who were involved in the overall study, the three coders generated a list of factors they believed to be important influences on fishing, boating, and beachgoing behavior. The factors were derived based on a review of the literature and an initial examination of the transcripts. The coders then created a list of definitions for each factor. The factors were grouped into four general categories, based primarily on the ideas contained in the Theory of Planned Behavior (Ajzen, 1991, 2002): (a) attitudes/perceptions of recreation that affected behavior; (b) external constraints on participation in recreation (i.e., factors arising from sources not directly associated with the individual); (c) internal constraints on recreation (i.e., factors arising from characteristics of the individual); and (d) perceptions about actions that friends or family think are right or appropriate.

Reliability Assessment

To ensure reliability (consistency across the different coders) the three coders first jointly coded one angler transcript. Two coders independently coded the first third of each of the remaining seven angler transcripts. The codes for each factor were then compared for agreement and reliability. Agreement was measured as the percentage of all instances in which the two coders agreed upon the application of a given factor to a particular section of text. For example, if coder A coded 8 instances of factor Y and coder B coded 9 instances of factor Y, with 7 of those instances overlapping, the overall agreement would be 70% (7 cases of agreement + the one case that coder A identified, but B did not, + the two cases that coder B identified that A did not). Five of the remaining seven angler transcripts obtained excellent reliability scores, having over 70% agreement on all 26 factors. One of the transcripts exhibited low agreement (<70%) on a single factor, and a second transcript exhibited low agreement on five factors. The coders reviewed and came to agreement on the correct factor in each instance of disagreement. After conducting the reliability analysis, a single coder coded the last 2/3 of each transcript (all three coders participated in this process, but there was no duplication of coding across transcripts). Having established strong reliability among coders during the coding of the angler interviews, a single coder independently coded each of the boater and beachgoer transcripts. The data were analyzed by generating frequency statistics for the number of times each factor was cited in each group of interviews.

IV. Results

This section is separated into three sub-sections, each describing the major findings from the particular recreational group. Two main questions guide the data collection and analysis in each set of focus groups:

1. How might (further) introduction of aquatic nuisance species affect recreational (i.e., fishing, boating, or beachgoing) behavior?
2. How might other influences affect those same recreational behaviors?

Anglers

Two main forms of data are presented. First, this section summarizes the total number of instances in which each factor influencing fishing behavior was discussed (defined as a single statement by one individual, set apart by statements from other people) throughout the eight angler focus groups. Of the 26 factors identified in the angler transcripts during the coding process, the top ten most cited are listed in this report (see Table 2). (Some factors that influence angler behavior would most likely not be affected by aquatic nuisance species; factors followed by a † are factors that could likely be connected to effects of aquatic nuisance species.) The second form of data presented here are quotes from the focus groups that capture the meaning of the factors discussed. While each factor highlighted may have been mentioned many times during the focus groups, certain quotes captured the essence of these influences on fishing behavior. It is common practice in focus group research to also provide the quotes as “raw data”.

Effects of Aquatic Nuisance Species on Fishing Behavior

Before discussing the most frequently cited factors that influenced fishing behavior for the focus group participants, and these factors’ potential connections to aquatic nuisance species, a brief overview is offered of the ways in which the participants explicitly described how aquatic nuisance species might influence their fishing behavior. On 64 occasions, a focus group participant identified a link between his or her fishing behavior and the presence of aquatic nuisance species. Anglers mentioned many different types of aquatic nuisance species that have affected their fishing in the past and expressed concerns about the potential advent of Asian carp in their area. An interesting pattern observed in most focus group participants, when they spoke of aquatic nuisance species, was that they mentioned their efforts to adapt. A participant from Bay City highlighted this mode of expression:

When the exotics came in and changed everything, then we had to learn to fish all over again; we learned that maybe you could get some steelhead at the top and, and then the lake trout at the bottom and so now we fish for whatever we can get and we’re doing different things.

Table 2. Most Cited Influences on Fishing Behavior

Influence (factor)	Number of times cited in angler interviews
Catch rate [†]	111
Fish size [†]	56
Equipment, boats, fishing gear available	54
Cost / gas usage [†]	50
Weather	47
Seasonality of fishing	46
Access	45
Social interaction	44
Fishing “quality” [†]	43
Fishing for itself	38

[†] These factors are those the researchers identified as potentially most closely linked with the effects of aquatic nuisance species.

A participant from Louisville, Kentucky, touched on the difficulty of adapting:

The river is impacted with all these invasive species and we all try to adapt, but sometimes it’s difficult ... We spent a whole springtime sitting trying to catch a fish and getting your line cut because of the zebra mussels. You’ve got to go to different line and you change your fishing techniques to adapt to that and so you kind of grin and bear it and, and hope for the best.

Participants also commented on how they might deal with Asian carp, should the fish appear locally. A person from Eagan expressed his perspective on how Asian carp would affect his fishing behavior; “Yeah it’s a lot of politics and that’s the bad news but personally, I will never stop fishing. I will find a way to fish.” The following discussion of factors affecting fishing behavior and quotes illustrating them reveal that aquatic nuisance species have the potential to affect anglers in very real ways, and may lead to reduction in overall fishing, changes in locations in which people fish, and overall enthusiasm for fishing. Nonetheless, an overarching sentiment pervaded the focus groups that even if fishing became worse, committed anglers would find a way to cope.

This report now examines the individual factors most commonly cited in the focus groups as affecting fishing behaviors. The arrival of new aquatic nuisance species might influence fishing behavior by affecting some of these factors, while they would not likely affect others. First described are influences potentially tied to the effects of aquatic nuisance species.

Factors Closely Related to Potential Effects of Aquatic Nuisance Species

Catch rate refers to comments about the number of fish caught during a fishing outing. A large number of interviewees spoke of the importance of being able to catch many fish. Some of these anglers spoke of their own interest in catching fish while others, notably charter boat captains, mentioned that their customers expect to catch many fish. While not every comment about the importance of high catch rates was related directly to concerns about aquatic nuisance species, the potential ability of aquatic nuisance species to cause decline in fish populations of other species has led to identification of catch rate as closely related to potential effects of aquatic nuisance species.

A man from Port Clinton, Ohio, speaking of himself and his friends, stated, “We fished the shoreline a couple times last year probably but it’s, it’s not even worth it to us. You know if we don’t catch ten, fifteen fish in two hours, it’s not worth it to us.” A charter boat captain from Bay City, Michigan, gave a response indicative of other captains:

There’s a difference between the way [he] fishes and I fish, because I have to produce numbers for clients. He can go and he can fish all day or not fish if the fishing isn’t good that particular day. He can do pretty much what he wants because he does not have to put fish in the boat.

Few anglers were willing to definitively state how many fish represented a “good catch” for a particular period of time; many indicated that it would vary based on the species, conditions, etc., but they did seem to have a general idea of what was acceptable and what was not. An angler from Eagan, Minnesota, expanded upon the importance of catching a good number of fish; “It’s no fun if you aren’t catching anything and you’re not catching anything of size.”

Fish size sometimes paired closely with catch rate, but was also often discussed separately or in conjunction with the theme of fishing simply for reasons of “fun.” Larger fish generally seemed to make the focus groups’ participants’ fishing experiences more exciting and rewarding. A man from Port Clinton offered, “If I go perch fishing I pretty much strictly fish in Canada because the perch are a lot bigger up there.” Another interviewee in that same focus group added, “The bigger the fish the more fun it is to catch.” These were indicative of many of the comments related to fish size. When an interviewee from Peoria, Illinois, was asked what he would do if fish size decreased in his fishing area, he responded, “Just find a body of water that has bigger size and more of what we want, whether that means driving farther or changing your methods.” Again, he pointed to a willingness to adapt to changes in fishing conditions. To the extent that aquatic nuisance species lead to reductions in the size of species that are popular among anglers, they may also lead to shifts in the locations where anglers fish most regularly.

Fishing quality, the ninth most cited influence on fishing behavior, is mostly a combination of aspects of the first and second most cited influences, catch rate and fish size. The statements the researchers classified as relating to fishing quality, however, were broader and did not make specific reference to quantity or dimensions of the fish. For example, an angler from Oswego mentioned, “I’m with [him], I go where the fishing is good. I live on Otisco Lake so I

literally fish every day if I feel like it.” Because this factor combines aspects of catch rate and fish size, as well as potentially other factors related to the desirability of fishing in a given location, it is perhaps even more susceptible to the effects of aquatic nuisance species. Anglers mentioned that they may reduce the number of days they fish or find new locations if the fishing is not “good.”

Less clearly connected to aquatic nuisance species, but still relevant to the effects of these species on fishing behavior, were discussions related to **cost**, and particularly the price of gasoline. If aquatic nuisance species displace people because they lead to less desirable fishing conditions, as is suggested above, they may further reduce the willingness to fish if the only remaining desirable fishing areas start becoming farther and farther afield. While some of the focus group participants made it clear that cost of fishing is less of an obstacle for them (e.g., the quote above from a man who stated he would just drive to wherever the fishing is good), for many respondents, the need to drive farther to reach a desirable fishing location seemed to affect their behaviors. An angler from Duluth, Minnesota, provided an example of a decision based on financial concerns:

We didn’t go to Lake Michigan this year because there’s three of us boats that usually go together, and we will come up with our diesel pickups. We went over the records of what we spent last year in gas and fuel. This year it wasn’t unattainable, but why throw away that money to go down there? We just, we stay and fish around here.

A focus group participant from Peoria discussed the interplay between expenses and catch rate, indicating that he and his friends sometimes make a trade off between the two:

We try to keep fairly close around Peoria just because there’s good lakes further away but everybody complains about the gas and everything, so for the most part we try to stay within an hour or so of Peoria, but there’s a few lakes they’re okay with driving farther if you catch a lot of fish.

Other Influences on Fishing Behavior Not Linked to Aquatic Nuisance Species

There were several other factors that the focus group participants cited as influencing fishing behavior that would likely not be affected by the arrival of new aquatic nuisance species. These factors are nevertheless important to understand because to the extent that anglers make decisions about fishing based on these factors, their behaviors will not change with the introduction of aquatic nuisance species.

The **equipment, boats, and/or fishing gear** available to anglers was a major influence on fishing behavior. Lack of availability of specific gear was cited as a limitation to fishing in certain areas or for specific species. An angler from Port Clinton explained a characteristic constraint the researchers often heard related to the specifications of his boat:

Things that will affect me the most are going to be wave heights. My boat’s 17’ and out on Lake Erie that’s not that big; that’s fairly small, so I get turned back a lot. A lot of

days I can't fish, or I have to fish some place where I really don't have confidence that I'm going to do well, but it's more sheltered.

A participant from Fort Wayne, Indiana, detailed the constraints attached to lacking a piece of equipment entirely; "Usually I fish from shore because I don't have access to a boat, and I do also fish ice fishing so that does allow me more access." While only tangentially related to presence of aquatic nuisance species, one could conceive of instances in which presence of such species lead to reductions in desirable fishing areas, further limiting the places in which an angler wishes to fish. The combined constraints of only having particular gear or equipment available and only having certain desirable fishing areas available could produce fewer feasible fishing locations.

Related in some ways to the influence of equipment and accessories, but also with many independent consequences of its own, were the effects of **weather** on fishing behavior. When speaking about the frequency with which and the locations in which he fishes, an angler from Bay City stated, "It depends on conditions...the weather was horrible this year on Lake Huron, we had days and days we couldn't get out, so you're focusing in other areas." An interviewee from Duluth expressed another common sentiment, noting that he simply will not fish in some conditions, "I fish every weekend that I can. But if there's an east wind, you know, I'll stay home."

While the focus group participants explained that Nature's hand could affect fishing in temporary and haphazard ways through weather, Nature also affects behaviors in a more predictable and less transient way through the **seasonality of fishing**. Some interviewees described how their fishing is constrained by the number of days they can physically be on the water, but other anglers, who specialize more particularly in one or two species, mentioned additional constraints. Speaking of the seasonality of certain locations, an angler from Port Clinton asserted:

I don't fish that [area] often. You've got to do that in the spring; by late summer it gets hit every day by guys like me out there catching them, and the fishing progressively gets worse. It sounds like East Harbor is nice in the fall.

A participant from Eagan spoke of variation in species:

I'm sort of an opportunistic fisherman and I like to fish when that particular specie is active, actively biting. I'll change species from month to month depending on what the water temperature is and whether it's in the stream or whether it's in a lake.

While aquatic nuisance species obviously have no effect on the occurrence of spring, summer, and autumn, they may limit the ranges during which particular species are readily available and, thus, frustrate anglers who are used to fishing for certain species during specific months of the year. This could lead to reduction in fishing effort or a change in fishing location. Nevertheless, the second quote above provides another example of an angler's willingness to adapt.

Some influences on fishing behavior functioned as constraints, limiting fishing in certain circumstances, but also as factors promoting fishing in others. **Access**, for oneself and/or one's equipment to bodies of water, was one such influence. An angler from Bay City explained how ease of access could make fishing more inviting, "We have an 18' boat that we take out right there in town. We're lucky, the harbor is right there and just a few blocks from our house." An interviewee from Peoria described how lack of access could make fishing difficult and limit frequency of and locations for fishing, "Right now you can't even get in there with a boat even because it's so dry. It's like certain areas of Lake Story are so bone dry that there ain't no water there."

Social interaction seemed to affect fishing behavior differently from many of the other influences. Rather than primarily shaping the frequency with which one fished, social interaction seemed mainly to affect the anglers' approach to fishing. Some people spoke of fishing with their families, and how they might try for species they would not otherwise fish for when with their wives, children, or grandchildren. Others seemed to treat fishing as a more laid-back endeavor when fishing with friends. A man from Port Clinton stated, "It's probably 3 years maybe; I've been doing this every Wednesday, that's how we hang out." An interviewee from Oswego, New York, explained how spending time with friends influences the location in which he fishes:

I have friends that come out of Marion Manor and I generally fish with them when I go down there, and if I don't fish with them, they give me where to go and what to do and when to do it, so I fish that a lot on the east end.

While no interviewee articulated it explicitly, aquatic nuisance species could affect fishing behaviors through the influence of social interactions by making certain fishing locations less desirable (due to catch rate, size, etc.). Most of the participants in the focus groups were dedicated anglers, but many also mentioned that the family members that they fish with are rather casual anglers. Therefore, while a dedicated angler may be able to adapt, to grin and bear it, if fishing quality declines, this may not be true of the people with whom these dedicated anglers occasionally fish.

Fishing for itself is the name given to a factor that categorizes a series of comments that were almost in direct opposition to the statements about the importance of catch rate or fish size. This attitude expressed a vision of fishing as something beyond the fish themselves. An interviewee from Bay City explained:

I'm just a fisherman. I am going to fish somewhere, sometime, so many days out of every year. Whether I catch fish or not is irrelevant. ... I'd like to. I have every intention of doing so, but nobody lives or dies if I don't.

An angler from Fort Wayne expressed a similar sentiment that catching fish is not necessary for a positive fishing experience:

To me it's not so much going out and catching fish; it's just to get away from when I was working. It was just to get out, just to relax just to you know to go out. I mean catching fish to me was, is a plus obviously, but I've had some really wonderful times not catching anything.

While many anglers who cared deeply about catch rate and fish size indicated willingness to adapt to changing conditions, potentially caused by aquatic nuisance species, the anglers who cited "fishing for itself" showed a willingness to adapt in a different sense. They may not need to find a new location or a different method of fishing if their real purpose in "fishing" is more about broadly enjoying nature, being with friends, or taking in the quiet and solitude of a favorite fishing spot. Nonetheless, the factors catch rate, fish size, and fishing "quality" (considered together) were cited over five times as often as fishing for itself was cited.

Responding to Change

Some influences showed real potential to limit or displace fishing activity, but above all there was an overarching sense of the ability to adapt or to substitute a new location, mode of fishing, species, or activity for one's current approach to fishing.

Many participants identified ability to adapt as a characteristic of true anglers. An interviewee from Port Clinton described how shifting fishing location or size of fish is one way to adapt if fishing quality changes:

We'd find somewhere else. ... I've gone before to a couple different reservoirs and haven't caught anything two, three times, but I'll even change to smaller fish if I have to; the goal is to not get skunked when we go fishing.

An angler from Eagan expressed that no matter how bad the fishing conditions, he will find a way to continue his activity; "Personally I will never stop fishing for anything. I'll catch fish. God forbid something happens where everything gets wiped out by the invasive species, I'll still go fishing. I am a fisherman." Many of the anglers who attended the focus groups were long-time, very committed anglers. The extent to which other anglers, who are newer or less committed, would exhibit equal willingness to adapt and substitute is an open question, but it is unlikely that less devoted anglers would exhibit a similar fervor.

Boaters

Boaters are another major recreational group potentially affected by presence of aquatic nuisance species. There is some overlap between anglers and recreational boaters - many anglers fish from boats and many recreational boaters also fish to some extent. Boaters, nonetheless, pursue a wider range of activities on the water, from boating in order to find desirable places to swim, to water-skiing, tubing, relaxing on a Sunday afternoon, and engaging in non-motorized activities such as sailing, kayaking, and canoeing. The range of ways in which aquatic nuisance species could affect boaters is, thus, quite diverse. Asian carp that jump at the sound of an engine certainly have the potential to affect activities involving motor boats,

particularly those activities that involve towing someone (often children) behind a boat. Less obvious are the effects of zebra mussels, which could reduce boating by covering sandy beaches that boaters frequent with sharp broken shells. Thick mats of milfoil or other nuisance non-native aquatic weeds can also lead to an aesthetically (visually and olfactorily) unpleasant experience that could reduce or displace boating.

Based on the idea that different types of boaters will experience aquatic nuisance species-related impacts differently, the focus groups included a wide range of boaters. Motor boaters were the most common participants, followed by kayakers and sailors, but the groups also included people who jet ski, water ski, use boats for tubing, use boats to take them to remote areas for swimming, work as charter fishing boat captains, and people who snorkel or dive from boats.

Of the 38 factors identified as influencing boater behavior, this report lists the top seven most cited (see Table 3; these are the factors that were cited at least ten times across the three focus groups; factors followed by a † are factors that could likely be connected to effects of aquatic nuisance species). As in the section on fishing behavior, the report presents both the number of times each factor was mentioned and quotes to illustrate each factor.

Effects of Aquatic Nuisance Species on Boater Behavior

Before discussing particular influences on boating behavior, and their potential connections to aquatic nuisance species, a brief overview is offered of the ways in which the focus group participants explicitly described how aquatic nuisance species influenced or might influence their boating behavior. On 55 occasions, a focus group participant linked boating behavior directly to the presence of Asian carp, on 51 occasions boating behavior was linked to aquatic weeds or algae (although not all references were to invasive/exotic weeds), and on 18 occasions participants connected boating behavior and the presence of zebra mussels. Effects of other aquatic nuisance species on boating behavior, such as round gobies, were cited only sporadically.

Asian carp were the most discussed aquatic nuisance species. The potential effects of Asian carp on boating behavior fit into many categories. Some people were concerned about their own safety and/or that of their families; others, particularly those from the tourist towns of Alexandria Bay, NY, and Put-in-Bay, OH, were worried about potential effects on tourists' desire to come to an area where aquatic nuisance species were prevalent.

A motor boater from Alexandria Bay explained how safety concerns associated with Asian carp would lead to behavior change; "We have grandchildren. I can tell you right now, that'd be the end of their going with us." Similarly, a motor boater from Pella stated, "As [our children] start having grandkids, we'll be back out there pulling and tubing. And we would not do that on a lake where the invasive fish would be jumping. We wouldn't. We would go somewhere else." Many people spoke of how certain activities, or doing certain activities with particular people, would end in the presence of the carp. A kayaker from Pella spoke of his own personal safety when he asserted, "When I saw that Asian carp jumping, I wouldn't kayak like I did today." This

Table 3: Most Cited Influences on Boating Behavior

Influence (factor)	Number of times cited in boater interviews
Effects on fish [†]	22
Water clarity [†]	18
Tourist culture [†]	15
Health / safety [†]	14
Weather	12
Visual beauty [†]	10
Cost / gas usage [†]	10

[†] These factors are those that the researchers identified as potentially most closely linked with the effects of aquatic nuisance species.

man earlier spoke of someone being forced to quit a kayaking race due to being hit in the head by a jumping carp.

A boater from Put-in-Bay expanded upon the theme that some types of boaters may react differently to the carp than others:

I think that if they were jumping into the boat, I bet these guys who come here to party would get real close, so they could throw them out or club ‘em to death. But I think it would bother the families in small boats. I think if a fish that big jumped into a boat that had a six year old girl sitting in it, she wouldn’t want to come back in the boat again.

Another Put-in-Bay boater reflected on how this sort of change could affect the town in which he lives:

I think the biggest effect it would have here would be on tourism for fishing. You wouldn’t see those groups of a hundred boats out there, especially the charter boats.

Whether it was because of fears about safety for oneself or someone else, or simply a desire not to be annoyed by fish that are literally in one’s face, several of the participants seemed ready to stop at least some forms of boating due to the presence of Asian carp. The financial implications of this are clear, especially for the tourist towns whose lifeblood depends on a culture of boating.

Participants in the focus groups were asked to share how any type of aquatic nuisance species, not just Asian carp, might affect their boating behaviors. Aquatic weeds and algae, mentioned 51 times by the focus group participants, were a close second to Asian carp in the number of times cited. Some people spoke of aquatic weeds as a nasty, disgusting thing to which they did not want to expose themselves or their families, while others were concerned about the weeds’

effects on the local water-based economy. A third common concern with aquatic weeds was their propensity to clog motors or to block passage, making boating impossible. An interviewee from Alexandria Bay clearly articulated a prevalent concern of several participants:

When my boys were young, they used to sail the mini sailfish. Nobody could use it now. You put a rudder in that thing and you're going nowhere. The wind may come and you're just going over, because it clogs. They were always out there water-skiing. Now it's zoom, stop, back up, get rid of the weeds, go again ... You just can't. It's all weeds.

While some of the interviewees quoted here were referring to experience with native aquatic vegetation, and others referenced struggles with invasive weeds, all of the quotes help reveal how future aquatic nuisance vegetation could affect boating behavior. A boater from Put-in-Bay highlighted conversations he had with several local boaters when he made the following statement about why aquatic weeds are particularly bothersome to boaters:

It's the stuff that they can see on the lake that people are concerned about. We don't see the zebra mussels, or round gobies. Hey, they're in the lake. Did anyone ever call [the Chamber of Commerce] and say, "I'm not coming to Put-in-Bay because of round gobies?" But certainly, the algae, the stuff that you can see.

This interviewee once again highlights the potential effects of certain aquatic invasive/exotic species (as well as native aquatic weeds and algae) on tourism, pointing to relevant economic implications.

Zebra mussels were not cited as affecting boating behavior nearly as often as were Asian carp, but they were still the second most cited aquatic nuisance species of concern (because the aquatic weeds/algae factor included native species as well). Most concerns about zebra mussels were expressed by boaters who enjoyed swimming or spending time on beaches as part of their boating experience. For example, a motor boater from Alexandria Bay noted, "I used to like to go swimming with my bare feet. That doesn't happen anymore, because when you come out, there's blood on the rocks, in the sand. It's all zebra mussels."

Much of the discussion in the focus groups, however, did not refer specifically to aquatic nuisance species, but rather to factors influencing decisions about boating – some of which could be affected by aquatic nuisance species. The discussion below lists and explains the individual factors most commonly cited in the focus groups as affecting boating behaviors. The influences potentially tied to the effects of aquatic nuisance species are described first.

Factors closely related to potential effects of aquatic nuisance species

Even though the three focus groups discussed in this section were with boaters, many of the participants also fished, and others were particularly concerned about effects of aquatic nuisance species on the ecosystem or on the local water-based tourism economy. For these reasons, **effects on fish** was the most commonly cited factor. An interviewee from Alexandria Bay succinctly summarized a common concern, "We've had a multi-million dollar fishery in Lake

Ontario and the St. Lawrence River. ... If we let Asian carp into the Great Lakes, it will be, probably be, the demise of our fishery as we know it today.” Fewer people would engage in boating in the Alexandria Bay area if the fish were affected because that is a major reason for boating locally.

Water clarity related predominantly to feelings that the water that was not clear was simply not pleasant enough to recreate in. A boater from Pella offered such a sentiment; “I usually avoid going on the water when the water’s scummy or doesn’t smell good.” Many focus group participants related problems with water clarity to presence of aquatic weeds, although not many of them differentiated between native and non-native weeds. The only positive effect of aquatic nuisance species that was discussed frequently in the boater focus groups was the ability of zebra mussels to improve water clarity. In this sense, the economic effects of zebra mussels seem more ambiguous than the effects of a species such as Asian carp. It is difficult to weigh the increase in boating from water clarity against the decrease from jagged shells on beaches; different people are bothered by each influence on boating behavior. Also, the mere presence of weeds or the zebra mussels rarely prevented boating altogether; the problem needed to reach some threshold to threaten to reduce activity.

Because two of the three towns in which the boating focus groups were located have economies heavily dependent on tourism, it seemed natural that presence of a **tourist culture** affected the ways in which aquatic nuisance species could influence boating behavior. The participants in the focus groups were permanent residents of the towns where the groups were conducted, but these residents were able to offer informed opinions about tourist behaviors from years of interaction with those who frequent their town. Tourists are a mobile population that may like a certain location, but if conditions change only slightly in an unfavorable direction, the tourists are able to find a new place to recreate. Changes in resource quality, thus, will likely affect tourists differently from local residents who boat. The focus group participants widely agreed that tourist culture affects boating behavior by making the boating population more mobile, more willing to switch location, than resident boaters are. A boater from Alexandria Bay, concerned about declining tourism in his town, suggested:

We’re really tourism-based here and we draw from all around the country...You see a lot of boats coming up Route 81, the main corridor. Those people may go elsewhere. So if we have major changes, whether they’re coming here to go water skiing, they’re coming here with their jet skis, or they’re getting hit with Asian carp or whatever that’s coming into the Great Lakes, they may take their boating someplace else...It’ll affect the economy big time.

Multiple quotes have already been presented related to **health / safety**, in addition to the other influences with which they were associated. This factor covered concerns about personal and family well being, and the viewing of potential dangers as either a constraint that prevents boating or makes it undesirable. A motor boater from Alexandria Bay emphasized the importance of safety in relation to potential introduction of Asian carp:

We'd have to design a whole new boat. We'd have to have a cage around it. You'd have to have a football helmet on and armored plating on to ride your jet ski. I don't think I want to get hit by a 30 pound carp going 40 miles an hour. It'd probably break your neck. It would probably decapitate you.

Visual beauty was cited when interviewees discussed how the aesthetics of a place can lead them to recreate in one location versus another. An example comes from the previous quote of the Put-in-Bay boater that estimated how visual problems can drive tourists away most quickly. Kayakers from Pella mentioned that they drive over an hour several days a week to kayak on a lake with stunning palisades. If flying fish (Asian carp), jagged shells on beaches (zebra mussels), or unpleasant weeds thickly covering the water damage the aesthetics of a location, several boaters indicated their willingness to stop recreating or find somewhere else to boat.

Cost / gas usage is basically the same influence as it was in the angler interviews. Interviewees mentioned reducing or (on rarer occasions) stopping boating if the price of gas or other traveling expenses became too high. Again, it has the potential to reduce boating or to displace boating so that economic benefits associated with this form of recreation accrue to different towns, villages, and regions.

Other Influences on Boating Behavior Not Linked to Aquatic Nuisance Species

As with the angler interviews, and for many of the same reasons, **weather**, was an often-cited influence on boating behavior. A Pella boater explained how weather affects the location of his boating, and his means of access:

Lake Red Rock is big enough that if you're going to boat in a power boat, you boat basically on the side of the lake where the wind is coming from. In the summertime, typically the wind's coming from the southwest, so we have a tendency to use the ramps or boat across because the swells can get a pretty good size.

Responding to Change

Despite some boaters flat out stating that they would quit boating altogether or cease certain types of boating activities in the presence of Asian carp or aquatic weeds / algae, many discussed their willingness to adapt or substitute a new activity or location for their current ones. A frequent recreational boater and charter boat captain from Alexandria Bay stated:

The communities along the river and the lakes, they've always adjusted, they've always adapted. And we will continue to. There's no part of my brain that thinks we'll fold up our tents and go away if the Asian carp comes. We'll find a way to adapt to it. It'll be miserable and it's gonna be an expensive thing, but...the only thing that we've had control of is how we respond to it, and how we adapt to it.

A boater from Pella similarly explained how Asian carp may also be something to which local residents could adapt, in the way that others have already adapted:

Some of my friends live in Quincy, Illinois, right there on the Mississippi, they just hear all the time that their friend is out boating and all of a sudden they get hit by a fish, because there's a ton of them down there. So it's just a nuisance for them, just normal.

While many boaters exhibited a willingness to adapt or to substitute different activities or locations for currently used ones (this capacity was mentioned 38 times in the boater interviews), the focus groups revealed that this willingness might vary based on the type of activity in which boaters engage. On sixteen occasions across the three focus groups, boaters stated that the influence of the aforementioned factors on their behavior would depend upon the type of boating activity in which they were engaged. One boater at Pella described how the effects of Asian carp on sailors and kayakers versus motor boaters may be different; "My guess for the paddlers and the sailors is it would probably not be that big an issue." After this statement, many other kayakers and sailors chimed in, only half jokingly, expressing that Asian carp may be a good thing if these fish limited the number of motor boats on the lake. A motor boater from Pella underscored the potential effects of Asian carp on family outings; "For family activities, if you're skiing, knee boarding, or tubing, most of that is with families. If it's not safe, you're not going to do it. They'd have to stop." A boater from Put-in-Bay, however, questioned the extent to which one could escape the effects of Asian carp; "I wonder what the option's going to be if you've got those big fish jumping into your boat. That's not location specific."

Beachgoers

These three focus groups included a range of beachgoers. A majority of participants used beaches for swimming, but many also cited using the beaches as entry points for boating (particularly kayaks and small sailboats), as places to bring their children (who would often be swimming), as locations to hike, to relax, to play volleyball, and to walk one's dog. Aquatic nuisance species were cited as potentially affecting each user group, but for different reasons. Some of these differences are highlighted in the paragraphs that follow. Of the 35 factors identified for the beachgoer transcripts, this report lists and explains each factor that was cited at least ten times across the three focus groups (see Table 4).

Effects of Aquatic Nuisance Species on Beachgoer Behavior

Asian carp, which were cited 45 times as affecting beachgoing behavior, influenced behavior by causing many interviewees to express that they would avoid beaches and the water if carp were present, because they viewed the carp as scary, unsafe, or generally repulsive. One woman from Chicago, Illinois, simply stated, "It would definitely affect - Asian carp in Lake Michigan - I would never go in the water." Another person at that same interview explained how Asian carp could drive one away from beaches, or a town, even if the primary use of the water is not for swimming:

When we're playing volleyball, we do use the water. We're not really swimming, but we always go in to clean off and to cool down. I think that depending on the level and the number of carp swimming around, I would cease to do that, and that would probably slow me down from wanting to go to the beach. And to be honest, a long term effect would probably be me not wanting to stay in Chicago. I stay here only because of the summers. There's really nothing else holding me back from moving to Denver, California, or somewhere else.

While most of the reactions to Asian carp were not so intense, many focus group participants noted that the carp would make them reconsider beach activities on some level. A man from Traverse City, Michigan, explained how Asian carp might affect beach use, even if they have little actual effect on the types of activities in which beachgoers engage; "I think it would be a negative impact on the beaches too, at least initially, just because of the unknown."

Zebra mussels, the second most cited aquatic nuisance specie affecting beachgoing behavior, with 29 citations, played a unique role in revealing how aquatic nuisance species affect beachgoing behavior. For the vast majority of the participants at the three focus groups, zebra mussels were the only aquatic nuisance species with which they had substantial direct experience. Many beachgoers had dealt with the issue of zebra mussels for over a decade. The most common concern about zebra mussels related to cutting one's feet when walking on a beach or in shallow water. Yet, a large majority of the participants expressed their readiness to adapt to the new beach conditions. For example, a beachgoer from Traverse City cited a similar concern to the previously quoted boater from Put-in-Bay, the thought that visual effects are more important than things such as zebra mussels:

I think what will keep me from going to beaches is anything that is unsightly that detracts from the whole experience. I can walk on those types of shells - zebra mussels with shoes, but weeds are unsightly; it's just not a good experience.

As in the boater focus groups, both native and exotic aquatic weeds and algae were cited as affecting beachgoing behaviors (24 citations). Interviewees mentioned how weeds limited the areas where they could physically boat. A sailor from Minneapolis recalled, "It does inhibit the areas you can sail on [Lake] Calhoun. There's a big shallow area that you can't use; you can't sail through in the summertime." Another Minneapolis participant detailed the more common reaction to aquatic weeds and algae, that they simply make spending time on/in the water unpleasant:

I mentioned we were down in southern Minnesota kayaking on this lake, and it was scummy and nasty and we won't go back there. So I don't know how much scum there has to be there before you do not go back. Well, when we were there it was scummy enough not to return.

Table 4: Most Cited Influences on Beachgoing Behavior

Influence (factor)	Number of times cited in beachgoer interviews
Water clarity [†]	34
Health / safety [†]	22
Visual beauty [†]	22
Seasonality of use	21
Yuck factor [†]	17
Distance from home	16
Access	14
Fear / unknown [†]	12
Pollution	12

[†] These factors are those that the researchers identified as potentially most closely linked with the effects of aquatic nuisance species.

Factors Closely Related to Potential Effects of Aquatic Nuisance Species

Water clarity, which was an influence on fishing and boating behavior, played a heightened role in the beachgoer interviews. Sometimes water clarity was an influence that encouraged the focus group participants to use a body of water, due to being very clear, or dissuaded them from using it, due to murky waters or high levels of sediment. Low water clarity made some interviewees feel unclean, it caused others to feel unsafe, either for themselves or for their children. A man from Chicago explained, “The visibility of the water – we were talking about that today. That’s a big thing. Like, I’m swimming and it’s really muddy, and kind of scary, there might be something down there. I won’t be able to see the Asian carp.”

Concerns about **health and safety** were, as in the boating interviews, once again a frequently cited influence on behavior. The reasons for health and safety being a concern were similar – interviewees stated that they would not want to expose themselves, and particularly their children, to harm potentially caused by aquatic nuisance species. A beachgoer from Traverse City clearly expressed this sentiment; “If there’s a potential for my kids to be hurt or me to get hurt by big fish, by swimming out on my favorite beach, there’s going to be one less beachgoer.”

The aesthetics or **visual beauty** of the beaches and water was again an often-cited factor that made people want to use the beaches, or led them to choose one location over another. A woman from Chicago shared this outlook:

I see that water everyday, and when I get frustrated with work, I turn around and that’s what I look at. I want to keep seeing that. ... When tourists come to town and you take

your friends up to the 96 Lounge in the John Hancock Building, it's to look at the water. It's what you can see from all the buildings around Chicago. It's our mountains.

While the factor termed **"yuck factor"** did surface in the boater interviews, it was not mentioned frequently enough to rise into the top cited influences on behavior. In the beachgoer focus groups, participants repeatedly mentioned that they had avoided areas, or, in the future, would avoid areas for recreating, because the locations are gross, nasty, unpleasant, scummy, etc. People referred to both visual and olfactory offenses. A beachgoer who also kayaks in Minneapolis stated why she no longer kayaks in certain areas, "There'd be like floating algae in the water so thick that trying to kayak through it was just nasty." A woman from Traverse City expressed her frustration with dealing with what she considered to be unpleasant fish:

My answer to your question about what would stop me from going is if I'm out at West Bay and the Asian carp are jumping, I'm done. There are certain things that I just can't - as much as I love to swim, I just can't.

In the discussion above of the influences of Asian carp and water clarity on beachgoing behavior, it is evident that some people were willing to discontinue beachgoing activities, to engage less frequently, or to switch to new locations because they found the fish to be scary or were uncertain of how the fish may affect them. **Fear** and the **unknown** drove them away. A Traverse City beachgoer put this matter quite plainly; "I'm more of an alarmist, and I'm more fearful of the Asian carp. ... Asian carp scare the daylights out of me."

Other Influences on Beachgoer Behavior Not Linked to Aquatic Nuisance Species

Seasonality of use is a factor that refers to both temperature and weather constraints that prevent people from engaging in certain forms of beach recreation at particular times of year, but also to attitudes about when particular forms of recreation are most enjoyable. After describing how she swims only seasonally, a beachgoer from Minneapolis described how she can use the beaches for other activities twelve months each year; "Walking, I'm probably out on the Mississippi River three to four days a week. Already been down there early spring. Dog's been in the water. I do that year round."

Distance from home was another factor that appeared in the angler and boater focus groups, but that did not rise to the top of the list of most cited factors. The closer to home a beach is, the more likely one is to use it. This seems intuitive, but several interviewees shared the more nuanced assertion that they may be willing to travel farther for certain activities, but not for others. People who could carry their boats from their homes to the water mentioned that if this were not the case, their amount of boating may decrease considerably. A kayaker from Minneapolis offered, "One is proximity. We live by [Lake] Calhoun. [Because] the three lakes of Cedar, Calhoun, and Harriet are connected, we run those lakes and Minnehaha Creek and kayak because we can just walk our kayaks down there." A beachgoer from Traverse City explained that dog walking on the beach is not an activity for which one will generally get into a car and drive:

I agree 100%. I have a dog I walk probably about 5 times a week on the beach, and I use what's closest to me. It makes a difference what's in your neighborhood. If you can walk it, it's that much greater.

While distance from home is classified as a factor not closely linked with aquatic nuisance species, some interviewees did make the assertion that they would likely go to the beach less, particularly for certain activities (such as dog walking) if beaches by their home became undesirable due to aquatic nuisance species.

A top influence on fishing behavior, **access**, reemerged in the beachgoer focus groups as important, and was manifest in similar ways. A beachgoer from Minneapolis, for example, explained how the infrastructure locally promotes beach usage:

Minneapolis has a wealth of walking trails around the lakes or around the rivers. They have boat ramps - when I say Minneapolis I just mean the metropolitan area - they have much greater infrastructure here than almost any other place I've ever been as far as the amount of different things you can do on the water.

Pollution influenced beachgoing behavior for reasons of health / safety as well as connection to the yuck factor. People expressed that they would find a new location or stop swimming altogether if pollution got bad enough. Particularly in Chicago, pollution referred to anthropogenic introductions into the water such as trash and sewage. In Traverse City, dead fish and birds washing up on the shores was a form of pollution that drove beachgoers away.

Responding to Change

The focus group participants' proclivity to adapt their behavior or substitute other locations for recreation, in light of potential threats to current practices, was cited 46 times across the three focus groups. Many interviewees did cite various factors that would lead them to stop certain types of beach recreation altogether, but as in the boating and fishing interviews, a perspective of resilience seemed to be more prominent. A beach volleyball player from Chicago explained how she would likely respond to Asian carp:

If I have a job here, and I can't leave tomorrow, and all of a sudden Asian carp came in, I'm probably still gonna play beach volleyball. It's gonna suck, and I'm gonna hate it, and I might even be looking for other jobs, but you're gonna get used to it.

The idea that people may be able to deal with the effects of aquatic nuisance species, but that it would lead to a diminished experience, was prevalent in all three interviews. A beachgoer from Minneapolis offered a similar sentiment with respect to swimming and kayaking from local beaches, if aquatic nuisance species were to arrive; "You do it at the same time just as much, but bitch about it."

While the previous two quotes speak to anticipated reactions, several interviewees also spoke of how they have already adapted to other aquatic nuisance species, such as zebra mussels:

My family has a portable basket of shoes. Of every different size for every single town. We addressed that idea probably ten years ago downstate, and this basket just goes with us. It's not a pretty sight, but it's just - we've adapted because of the zebra mussels. So we would never exclude a beach because of the zebra mussels, we'd just adapt accordingly.

It is important to note that most of the focus group participants perceived there to be a number of locational substitutes for where to recreate. No beachgoer indicated so strong an attachment to a single beach that he/she was unwilling to also use other beaches. Having multiple locations available increased the participants' willingness to adapt by using different beaches. A Traverse City beachgoer explained, "We have the luxury of going to another beach, or going inland to a lake. What is Chicago going to do? They just got one main strip there in terms of beach." Despite this concern for Chicago, several of the Chicago participants expressed the belief that they have access to a diversity of locations. One interviewee, however, questioned whether the average beachgoer in Chicago may share this perception. Speaking to the other interviewees, he explicated:

So you're able to make your decision based on knowledge of how [ecology] works. But, I don't know one beach from another or what types of beaches are better for what types of bacteria or weeds. So my natural reaction is to say, "It's not the beach that's bad, it's Lake Michigan that's bad." Because, it's all the same lake.

Beachgoers like this man would have lower substitutability than the other interviewees; they would be more likely to avoid beachgoing altogether, should a problem or threat emerge.

V. Conclusion

Effects of Aquatic Nuisance Species on Fishing, Boating, and Beachgoing

Aquatic nuisance species have potential to influence many of the factors cited as affecting angler, boater, and beachgoer behavior. For example, catch rate and fish size were vastly important factors affecting angler behavior (and, to a slightly lesser extent, boater behavior) that could be influenced by the effects of aquatic nuisance species. Likewise, water clarity, personal and family health and safety, and visual beauty, were central factors affecting boater and beachgoer behavior that could be affected by aquatic nuisance species. For each recreation group, there also were additional important factors affecting behavior that are unrelated to aquatic nuisance species. Weather, seasonality of recreation, and access were key factors affecting behavior across all three user groups that have little to no connection to the effects of aquatic nuisance species. In each user group (i.e., anglers, boaters, and beachgoers) the factors that were cited most often by focus group participants as affecting fishing, boating, and beachgoing behavior were related to the potential effects of aquatic nuisance species.

Because aquatic nuisance species could affect many different factors that influence recreational behavior for each user group, and because some of those factors top the list as the most often referenced factors affecting behavior, introduction of aquatic nuisance species into new areas could be expected to have noticeable impacts on anglers, boaters, and beachgoers. Most of these impacts would be negative, such as limiting the number of locations in which recreation is desirable, causing some forms of recreation to become more difficult, less fun, or less safe, and perhaps leading some people to forsake certain activities altogether. Nevertheless, a few impacts from aquatic nuisance species could be positive. For example, the increased water clarity provided by zebra mussels appealed to many of the focus group participants. This, combined with the fact that many people had learned to adapt to the jagged shells left on beaches from zebra mussels, could mean that some aquatic nuisance species may not be much of a nuisance; perhaps, rather, they can benefit certain anglers, boaters, and beachgoers.

Responding to the Effects of Aquatic Nuisance species

Even though the focus group participants seemed to be affected primarily negatively by aquatic nuisance species, people's behavior changes that accompanied the effects of nuisance species frequently showed resilience and willingness to adapt rather than a level of concern or frustration that would lead to disengagement from an activity. Substituting different locations or activities for current ones was a frequently cited approach to dealing with aquatic nuisance species. Several of the quotes from the results section indicate that if anglers, boaters, and beachgoers needed to, they would drive farther, spend more, or work more diligently to access places to recreate. Others mentioned that they would deal with these species simply by continuing what they do today, but being less happy about it. The mindset that one can and must adapt was particularly manifest in the beachgoer and boater focus groups, but it was also prominent in the angler focus groups. Recreationists repeatedly asserted that they would adapt and continue to recreate, even if it left them with a diminished experience. However, if the locations in which recreation occurs start to shift, local economic effects could be much more pronounced.¹

¹ When discussing the potential impact of aquatic nuisance species on recreationist behavior, it must be noted that the focus group participants in this study were mostly dedicated anglers, boaters, and beachgoers. These participants may not be (and, actually, are likely not) representative of anglers, boaters, and beachgoers in general in the areas where the research was conducted. The people who participated in the focus groups volunteered. The participants who attended were commonly more avidly attached to their form of recreation than others who also recreate in similar ways. In some instances, this difference could make the impact of aquatic nuisance species less severe for less avid recreationists. Reduction in catch rate or elimination of a favorite beach or boating area may not pose as large of an inconvenience. On the other hand, people who are not so passionately enthusiastic about their form of recreation may be more willing to stop altogether, rather than to adapt and substitute when an aquatic nuisance species changes their attitudes about recreating or constrains recreation possibilities.

Participants were more likely to adapt to some factors than others. For example, while water clarity and health/safety both played a prominent role in the boating and beachgoing interviews, lack of water clarity generally made people less likely to use, or more apprehensive about using, a water source for their preferred recreation. The health/safety influence, however, generally caused people to state flat out that they would not recreate in a certain way or place anymore. Therefore, while water clarity was mentioned more frequently in the last two sets of interviews, the health/safety influence may actually have a more lasting and detrimental effect on limiting recreation. When examining the effects of an influence, it is, therefore, important to consider not only the number of people who consider it to be a problem, but also whether it will cause those people simply to pursue their activity on the next lake, or to stop an activity entirely.

The “yuck factor” was another influence that seemed to have a powerful capacity to drive people away from recreation entirely. Whether it was bad aquatic weeds or nasty Asian carp, people indicated that these influences could cause them to quit recreating completely. Of course, the effects of Asian carp were a hypothetical for nearly all of the focus group participants. Therefore, it would be interesting to see whether and how attitudes might change over time. It is possible that certain aquatic nuisance species may make people want to discontinue their behavior, and may actually lead to a temporary break in that behavior, until they observe, either through mass communication, interpersonal conversation, or their own experience, that the effects are not as bad as they anticipated. Even very strong attitudes may change over time if people come to believe that the effects of an aquatic nuisance species are different than they anticipated. Such a change seems more likely than the change in an attitude itself. For example, if Asian carp were to decimate native fish populations, anglers that care greatly about high catch rates could continue fishing if they changed their attitudes to simply want less fish, or different types of fish. This type of attitude change might be more difficult or take longer time than learning more about the effects of a nuisance species.

Synthesis

In conclusion, aquatic nuisance species seem to have the capacity to affect fishing, boating, and beachgoing behavior in a wide range of ways, directly and indirectly. Some of the effects of aquatic nuisance species, and Asian carp in particular, can be expected to cause some individuals to cease certain forms of recreation. Children specifically may be engaging in less fishing, boating, and beachgoing if their guardians know that Asian carp are present. Many interviewees, nonetheless, demonstrated a strong resiliency and willingness to adapt to whatever new conditions arise. Very few interviewees disagreed, however, that the presence of Asian carp and other nuisance species would lead to a diminished recreational experience. Those who were not overly concerned about the presence of the giant fish generally responded with the half-hearted comment that even if it affected others badly, their form of recreation would be less affected. The vast majority of the focus group participants identified themselves as people who care not only about recreating, but about the greater ecosystem in which they live. The interviewees were not concerned simply about their own diminished experience, but also about the diminished beauty and diversity of the natural world.

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Appendix A: Interview Guide for Angler Focus Groups

Recreational Impacts of Aquatic Nuisance Species to the Great Lakes and Mississippi River Basins

Focus Group Interview Guide

1. Introductory Script

Statement of Purpose

Cornell University is conducting this study in cooperation with the United States Army Corps of Engineers to evaluate the effects of aquatic nuisance species on recreation in the Great Lakes and Upper Mississippi River Basins. The purpose of the focus group is to help us understand how recreational anglers make their choices about fishing – where they fish, what types of species they fish for, and how their fishing might change if the types of species that are available changed. Your ideas will help us to determine how anglers would be affected if aquatic nuisance species affected the types of fish that anglers could catch.

We will ask a series of questions for discussion, with no right or wrong answers. For most of these questions, we'd like you to answer in an open discussion. We may follow up with additional questions in response to particular points individuals raise. All perspectives are important. There are no right or wrong answers. We may check in with different individuals occasionally to find out if they agree or disagree with points that have been made.

Participation in this focus group is voluntary. You do not have to participate if you don't want to. You may also refuse to answer specific questions. There is no penalty to you if you decide that you do not want to complete the focus group.

Your identity will remain completely confidential. No one but the researchers in this study will be able to associate your responses with your name. We will not report results in a way that would allow other people to determine who made particular comments to us. We may use

direct quotations from some people in reports or publications, but we will delete any information that could be used to identify specific people before we do. The session will be audio-recorded and the recording will be transcribed.

2. Focus Group Questions

Opening Statement

Let's start by going around the table and have everyone introduce themselves.

Introductory Questions

First, I would like to ask you about your fishing preferences, addressing where you fish, how you fish, the species you pursue, and how often you fish.

1. Where do you go fishing? Where do you prefer to fish? Great Lakes? Inland lakes? Rivers and streams? Other locations?
2. What particular species do you fish for?
3. How do you go fishing? From a private boat? A charter boat? Shore? Pier? Other places?
4. How often do you usually go fishing?

Transition Questions

At this point, I would like to ask you about the reasons why you choose to go to particular fishing sites regularly over others.

1. What are your reasons for going to the site you most regularly fish? What about your favorite fishing sites?
 - a. The particular species that are available? The number of fish you catch? The size of the fish? The condition of the fish? To find edible fish? Good water quality? Natural beauty? Peace and quiet?
 - b. What kinds of features are important for you to have at your fishing sites? How important is it for you to have access to a boat ramp? To a bridge, pier, or beach?
 - c. How convenient is it for you to get to the locations you prefer? How far away are these locations? How long does it take you to get there? How much does it

cost you? Do you have to pay any access fees? Other costs? How much does cost matter?

d. How important is it to you to go fishing with particular people? Who do you prefer to fish with?

e. How long have you been going to the locations that you fish the most?

We have talked about the reasons why you choose to go to particular fishing sites regularly. I would like to understand a bit more about the importance of these reasons.

2. What is/are the most important factor(s) of all in choosing that specific location? What is/are the least important factor(s)?

We've been talking up until now about the reasons you choose particular fishing sites. But there also might be times when you are thinking about going fishing somewhere but decide NOT to fish at a particular spot or for a particular species. Maybe you choose a different spot or maybe you decide not to go fishing at all. We'd like to understand some of the reasons why you choose NOT to go fishing at some sites or for some species. (spot.)

3. When you decide not to fish at a specific location, what is the most important reason for not fishing there?
4. When you decide not to fish for specific species, what is the most important reason for not fishing for those species?
5. When you decide not to fish from shore, private boat, charter, or pier, what is the most important reason for not fishing from there?

Key Questions

1. Over the past 10 years, how has the type of fishing you do changed? Locations you fish? Species you fish for, how often you fish, or where you fish from? If you have made changes, can you tell us a bit about the reasons you've changed the type of fishing you do?

One of the things we're interested in is whether anglers might do things differently if there were changes in the species they fished for.

2. How would your fishing change if you only caught your preferred fish species about half as often as you do now at your favorite fishing sites (i.e., in your favorite spot it took you

twice as long to catch the same number of fish)? No change? Stop fishing? Or fish less frequently? (Or more frequently?) Fish for different species at the same location? Change where you fish from: shore to boat or vice versa? Fish at other locations for the same species?

3. How much would your catch rate have to decline to get you to stop fishing at that location altogether?

4. What would you do if the fish you caught were on average a lot smaller than those you usually catch now at your favorite fishing sites? No change? Stop fishing? Or fish less frequently? (Or more frequently?) Fish for different species at the same location? Change where you fish from: shore to boat or vice versa? Fish at other locations for the same species?

5. How small would the average fish have to get for you to stop fishing at that location altogether?

Ending Questions

One of the things we wanted to learn from you is how the way you fish might change if the species you like to fish for weren't as common or were smaller. We've talked about a lot of different things you might do.

1. Is there anything we haven't talked about that you think is important for us to know?

If you're interested in receiving a copy of the report we prepare based on this study, provide me with your address or email address. (*Provide them with my business cards.*)

THANK YOU!

Appendix B: Interview Guide for Boater Focus Groups
Recreational Impacts of Aquatic Invasive Species to the Great Lakes,
Upper Mississippi River, and Ohio River Basins
Focus Group Interview Guide - Boaters

1. Introductory Script

Statement of Purpose

Cornell University is conducting this study in cooperation with the United States Army Corps of Engineers to evaluate the effects of aquatic invasive species on recreation in the Great Lakes, Upper Mississippi, and Ohio River Basins. The purpose of the focus group is to help us understand how recreational boaters make choices about where they boat, what types of experiences they seek, and how their recreation options and behaviors might change if conditions changed in the lakes and rivers they use. Your ideas will help us to determine how recreational boaters would be affected if aquatic invasive species were to influence the conditions in lakes and rivers where you boat.

We will ask a series of questions for discussion, with no right or wrong answers. For most of these questions, we would like you to answer in an open discussion. We may follow up with additional questions in response to particular points individuals raise. All perspectives are important. We may check in with participants occasionally to find out if they agree or disagree with points that have been made.

Participation in this focus group is voluntary. You do not have to participate if you do not want to. You may also refuse to answer specific questions. There is no penalty to you if you decide that you do not want to complete the focus group.

Your identity will remain completely confidential. No one but the researchers in this study will be able to associate your responses with your name. We will not report results in a way that would allow other people to determine who made particular comments to us. We may use direct quotations from some people in reports or publications, but we will delete any

information that could be used to identify specific people before we do. The session will be audio-recorded and the recording will be transcribed.

2. Focus Group Questions

Opening Statement

Let us begin by going around the table and introducing ourselves.

Introductory Questions

First, I would like to ask you about your boating preferences, addressing where you boat, how often you go boating, any other activities you may engage in while boating, and what kind of boat you use.

1. How often do you boat?
2. Where do you go boating? Great Lakes? Inland lakes? Rivers? Other locations?
3. What else do you do when you boat (e.g., swim, water ski, fish, etc.)?
4. What type of boat do you use? (Tell me about your boat(s).) Kayaks, canoes, small sailboats, cruising yachts (motor or sailing), fishing boats with motors, speed boats? Do you own, borrow, or rent the boat?

Transition Questions

At this point, I would like to ask you about the reasons why you choose to go to particular recreation sites regularly over others.

1. Do you boat in many different places, or do you tend to go to a single place or a few places fairly often?
2. What are your reasons for going to the site where you most regularly boat? What makes your favorite site special and/or unique?
 - a. The types of activities you can engage in there? The number of other people using the site? The size or shape of the body of water? The water quality? Presence of desired facilities? Natural beauty? Peace and quiet?
 - b. What kinds of features are important for you to have at your boating sites? How important is it for you to have access to a boat ramp, marina, moorings, a yacht club, beach, waterfront restaurants, or other amenities?

- c. How convenient is it for you to get to the locations you prefer? How far away are these locations? How long does it take you to get there? How much does the amount of time it takes to get there matter to your decision?
- d. How much does it cost you to arrive at and boat at the location(s) you prefer? Do you have to pay any access fees? Other costs? How much does cost matter?
- e. How important is it to you to go boating with particular people? With whom do you usually boat?
- f. How long have you been going to the locations where you boat the most?

We have discussed the reasons why you choose to go to particular boating sites regularly. I would like to understand a bit more about the importance of these reasons.

- 3. What is/are the most important factor(s) of all in choosing that specific location?

Key Questions

- 1. Over the past 10 years, how has the type of boating you engage in changed? Locations you boat? Type of boats you use? If you have made changes, please tell us about the reasons you have changed.

One of the things we are interested in is whether recreational boaters might do things differently if there were changes in conditions of the lakes and rivers they use.

- 2. How would your boating change if:
 - a. You had to deal with thick mats or beds of aquatic plants/weeds in areas you like to boat?
 - b. If water clarity increased or decreased?
 - c. If jumping fish (carp) were present that could hit you or your boat while boating?
 - d. If jagged shells lined the water's bottom?
 - e. If areas you like to swim had higher levels of parasites that could affect humans?
 - f. If more bacteria that could make you sick were present in the water?

No change? Stop boating? Go boating less frequently? Pursue different activities at the same location? Change the type of boat you use? Go boating someplace else?

3. At what point would these effects cause you to stop boating at that location altogether?
4. How would your boating change if access points or bodies of water that you use for boating were closed?

Stop boating? Recreate less frequently? Engage in the same activities at another location? Other?
5. How would your boating change if there were increased regulations for preventing movement of aquatic invasive species?
 - g. What if you had to clean your boat each time after hauling it?
 - h. What if the boat had to be inspected before/after using it?
 - i. What if you were not allowed to transport your boat between certain bodies of water?
6. Can you think of any other factors that may cause you to stop boating, or cause you to go boating noticeably less frequently?

Ending Questions

Our primary interest is to learn from you how you might change your boating preferences if the condition of the lakes and rivers you use were to change due to presence of aquatic invasive species. We have talked about several different things you might do.

1. Is there anything we have not talked about that you think is important for us to know?

If you are interested in receiving a copy of the report we prepare based on this study, provide me with your address or email address. (*Provide them with business cards.*)

THANK YOU!

Appendix C: Interview Guide for Beachgoer Focus Groups
Recreational Impacts of Aquatic Invasive Species to the Great Lakes,
Upper Mississippi River, and Ohio River Basins

Focus Group Interview Guide – Swimmers and Beach Users

1. Introductory Script

Statement of Purpose

Cornell University is conducting this study in cooperation with the United States Army Corps of Engineers to evaluate the effects of aquatic invasive species on recreation in the Great Lakes, Upper Mississippi, and Ohio River Basins. The purpose of the focus group is to help us understand how recreational swimmers and beach users make choices about where they swim and enjoy beaches, what types of experiences they seek, and how their recreation options and behaviors might change if conditions changed in the lakes and rivers they use. Your ideas will help us to determine how recreational swimmers would be affected if aquatic invasive species were to influence the conditions in lakes and rivers where you swim.

We will ask a series of questions for discussion, with no right or wrong answers. For most of these questions, we would like you to answer in an open discussion. We may follow up with additional questions in response to particular points individuals raise. All perspectives are important. We may check in with participants occasionally to find out if they agree or disagree with points that have been made.

Participation in this focus group is voluntary. You do not have to participate if you do not want to. You may also refuse to answer specific questions. There is no penalty to you if you decide that you do not want to complete the focus group.

Your identity will remain completely confidential. No one but the researchers in this study will be able to associate your responses with your name. We will not report results in a way that would allow other people to determine who made particular comments to us. We may use

direct quotations from some people in reports or publications, but we will delete any information that could be used to identify specific people before we do. The session will be audio-recorded and the recording will be transcribed.

2. Focus Group Questions

Opening Statement

Let us begin by going around the table and introducing ourselves.

Introductory Questions

First, I would like to ask you about your preferences related to beaches and swimming, addressing where you swim, what additional activities you pursue when swimming (e.g., sunbathing, playing beach sports, boating), and how often you pursue each activity.

1. How often do you go to beaches or go swimming?
2. Where do you go swimming? Great Lakes? Inland lakes? Rivers and streams? Other locations?
3. What else do you do when you swim (e.g., sunbathe, play beach sports, use watercraft, etc.)?
4. How often to pursue these other activities when swimming or at beaches?

Transition Questions

At this point, I would like to ask you about the reasons why you choose to go to some swimming sites or beaches regularly over others.

1. Do you swim in many different places, or do you tend to go to a few places fairly often?
2. What are your reasons for going to the site where you most regularly swim? What makes your favorite site special and/or unique?
 - a. The types of activities you can engage in there? The number of other people using the site? The size or shape of the body of water? The condition/quality of the water? Presence of desired facilities? Natural beauty? Peace and quiet?
 - b. What kinds of features are important for you to have at your swimming sites? How important is it for you to have access to sandy beaches, lifeguards, sports fixtures (e.g., a beach volleyball court), diving platforms, nearby restaurants or concessions, or other amenities?

- c. How convenient is it for you to get to the locations you prefer? How far away are these locations? How long does it take you to get there? How much does the amount of time it takes to get there matter to your decision?
- d. How much does it cost you to arrive at and swim at the location(s) you prefer? Do you have to pay any access fees? Other costs? How much does cost matter?
- e. How important is it to you to go swimming with particular people? With whom do you usually swim?
- f. How long have you been going to the locations that you swim the most?

We have discussed the reasons why you choose to go to particular swimming sites regularly. I would like to understand a bit more about the importance of these reasons.

- 3. What is/are the most important factor(s) of all in choosing that specific location?

Key Questions

- 1. Over the past 10 years, how has your use of swimming sites or beaches changed? Locations you visit? Type of waterfronts you frequent? If you have made changes, please tell us about the reasons you have changed.

One of the things we are interested in is whether people who go to beaches or swimming sites might do things differently if there were changes in conditions of the lakes and rivers they use.

- 2. How would your use of these sites change if:
 - j. You had to deal with thick mats or beds of aquatic plants/weeds?
 - k. If water clarity increased or decreased?
 - l. If jumping fish (carp) were present near your beaches and swimming sites?
 - m. If jagged shells lined the water's bottom?
 - n. If beaches and swimming sites had higher levels of parasites that could affect humans?
 - o. If more bacteria that could make you sick were present in the water?

No change? Stop going to these sites? Go to the beaches and swimming sites less frequently? Pursue different activities at the same location? Engage in the same activities at another location?

3. At what point would these effects cause you to stop using that location altogether?
4. How would your use of swimming sites and beaches change if access points, beaches, or bodies of water that you use for swimming were closed?

Stop swimming or using beaches? Swim or use beaches less frequently? Engage in the same activities at another location? Other?

5. Can you think of any other factors that may cause you to stop swimming or using beaches, or cause you to swim or use beaches noticeably less frequently?

Ending Questions

Our primary interest is to learn from you how you might change your use of swimming sites and beaches if the condition of the lakes and rivers you use were to change due to presence of aquatic invasive species. We have talked about several different things you might do.

1. Is there anything we have not talked about that you think is important for us to know?

If you are interested in receiving a copy of the report we prepare based on this study, provide me with your address or email address. (*Provide them with business cards.*)

THANK YOU!